## What is Claimed is:

- 1. A shape memory polymer comprising chemically cross-linked polycyclooctene synthesized from cis-cyclooctene having a high trans double bond content.
- 2. A shape memory polymer according to claim 1 which has been cured by adding dicumyl peroxide to the polycyclooctene.
- 3. A shape memory polymer according to claim 2 further cured through chemical crosslinking upon heating.
- 4. A shape memory polymer according to claim 3 which after curing is cooled to room temperature.
- 5. A shape memory polymer according to claim 1 having a molecular weight ranging (kg/mol) of about 120 to about 325.
- 6. A shape memory polymer according to claim 2 having a tunable transition temperature (T<sub>m</sub> of PCO) of about 19 to about 61 °C.
- 7. A shape memory polymer according to claim 2 having a melting point T<sub>m</sub> of about 16 to about 61 °C.
- 8. A shape memory polymer according to claim 2 having a crystallization point  $T_c$  of about 16 to about 39 °C.
- 9. A shape memory polymer according to claim 2 having a melting enthalpy  $\Delta H/J_g^{-1}$  of about 22 to about 63.
- 10. A shape memory polymer according to claim 2 having a melting point  $T_m$  of about 16 to about 61 °C, a crystallization point  $T_c$  of about 16 to about 39 °C and a melting enthalpy  $\Delta H/J_g$  of about 22 to about 63.
- 11. A shape memory polymer according to claim 2 having a degree of crystallinity at room temperature of from about 2.6% to about 25.5%.

- 12. A shape memory polymer according to claim 2 evidencing rapid shape memory behavior.
- 13. A shape memory polymer according to claim 12 wherein the primary stress-free shape of the polymer is recovered within about 1 second on exposure to temperatures above the melting point of the crystalline polymer phase.
- 14. A shape memory polymer comprising a blend of a polymer according to claim 1 with a member selected from the group consisting styrene butadiene, EVA and polyurethane.
- 15. A shape memory polymer molded article formed from a chemically crosslinked polycyclooctene according to claim 1.
- 16. A shape memory polymer molded article formed from the blend according to claim 14.
- 17. Method of forming a shape memory polymer comprising conducting a ring opening metathesis polymerization of cis-cyclooctene in the presence of a Grubbs catalyst and reacting the polycyclooctene formed with dicumyl peroxide at an elevated temperature to cure the polycyclooctene.
  - 18. Method according to claim 17 wherein said catalyst is RuCl<sub>2</sub>(=CHPh)(PCy<sub>3</sub>)<sub>2</sub>.
- 19. Method according to claim 17 wherein said catalyst is a dihydroimidazolyidenemodified Grubbs catalyst.
  - 20. Method according to claim 17 wherein said curing is carried out in a mold.
  - 21. A shape memory polymer produced by the process of claim 17.
- 22. An impression material for molding, duplication, rapid prototyping, and embossing comprising a shape memory polymer according to claim 2.
  - 23. A temperature sensor comprising a shape memory polymer according to claim 2.

- 24. A medical impression material for dentistry, orthopedics and podiatry comprising a shape memory polymer according to claim 2.
- 25. A shape memory polymer according to claim 1 containing a member selected from the group consisting of finely divided organic and inorganic fillers.
- 26. A shape memory polymer according to claim 25 wherein said filler is a member selected from the group consisting of born nitride, silica, titanium dioxide, montmullinite, clay, Kevlar, staple, aluminum nitride, barium and bismuth subcarbonate.
  - 27. A shape memory polymer according to claim 26 wherein said filler is boron nitride.
- 28. A shape memory polymer according to claim 27 wherein said filler is titanium dioxide.
- 29. Method for increasing the shape recovery rate of a shape memory polymer according to claim 1 which comprises incorporating therein boron nitride as a filler.
- 30. Method for decreasing the temperature for shape recovery of a shape memory polymer according to claim 1 which comprises incorporating therein boron nitride as a filler.
- 31. Method for simultaneously increasing the body-temperature modulus and the UV absorption of a shape memory polymer according to claim 1 which comprises incorporating therein titanium dioxide as a filler.